Research

Information bulletin

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FORFLO Model Used to Evaluate Greentree Reservoir Management Practices

Since greentree reservoirs (GTR's) were first established during the late 1930's in bottomland hardwood forests near Stuttgart, Arkansas, they have become a widely accepted form of waterfowl management in the Eastern and Central United States. Greentree reservoirs are areas of living hardwood forests that are shallowly flooded during fall and winter (and often into spring), to provide resting and roosting habitat and food for wintering waterfowl, commonly mallards (*Anas platyrhynchos*) and wood ducks (*Aix sponsa*). Recent studies, however, suggest that current water-management practices on many GTR's are causing long-term habitat degradation such as declining growth and mast production and increasing mortality in some tree species.

To address this issue, we used a bottomland hardwood forest succession model (FORFLO) to simulate the effects of several GTR management options available at Felsenthal National Wildlife Refuge, Ark. We collected data from a plot dominated by overcup oak (*Quercus lyrata*), Nuttall oak (*Q. nuttallii*), and water hickory (*Carya aquatica*) for the first set of simulations. The plot was on one of the lower sites within the GTR, and, with a 39% average annual flood duration, already had a long hydroperiod.

Lock and Dam Effects Assessed

The Felsenthal GTR had become operational in 1985, when the U.S. Army Corps of Engineers completed a lock and dam at the southern end of the refuge. The dam was constructed such that additional water could be impounded, backing up into an area of up to 8,907 ha (22,000 acres) of bottomland hardwood forest (the GTR). Because the lock and dam itself altered the hydrology within the GTR, we first ran a pair of simulations, one with and one without the lock and dam.

The two baseline simulations indicated that the lock and dam alone significantly affects the future composition of the plot modeled. The 14% increase in annual flood duration caused by the construction was not enough to affect the current overstory trees, but a trend towards wetter-site species was noticeable in the understory. The model predicted that baldcypress (*Taxodium distichum*), water tupelo (*Nyssa aquatica*), and water locust (*Gleditsia aquatica*) would become important components of future stands; it also predicted that, of the three dominant overstory species, Nuttall oak would decline the most in the understory and in future stands.

GTR Management Scenarios Simulated

Next, we simulated four potential GTR management scenarios. The first was the current management plan that calls for flooding to begin each year on November 1 and for removing all the water during most years by March 1. In the second scenario, flooding begins on October 1, and in the third, on December 1. The fourth scenario was similar to the first, except that during one year out of three, the GTR was not deliberately flooded.

Predicted trends in species composition for these four scenarios were similar to those of the baseline simulations: none of the scenarios affected current overstory trees, but the trend towards wetter-site species in the understory became increasingly pronounced. In the scenario with the longest flood duration (the October 1 scenario; 65% annual duration), baldcypress and water tupelo were predicted in 50 years to account for just over 50% of the total importance value (based on index of relative dominance, density, and frequency) of all understory species.

Implications for Waterfowl Management

Nuttall oak – the mast-producing species on the plot most valuable for waterfowl – is also the species most vulnerable to the increased flooding associated with the lock and dam and GTR management. The fourth GTR management scenario, with periodic drydown years, is the best for ensuring future Nuttall oak regeneration; but even with this scenario, Nuttall oak will be a minor component of future stands.

Managers possibly may influence the plot's future composition by overstory harvesting and by using a more flexible water management plan than any of those tested. A year with good Nuttall oak seedling establishment could be followed by 2 or 3 years with no deliberate flooding and then by an overstory thinning. Increasing the amount of light reaching the understory should result in improved survival and growth of the relatively shade-intolerant Nuttall oak seedlings and should help ensure that this important species remains a significant component of future stands.

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